

REMARKS

Claim Rejections – 35 U.S.C. § 102/103

The Examiner has rejected claims 1-6, 14, 17, 18 and 21-23 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer et al. (US Pub No. 2001/0011740). The Examiner has rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer (US Pub No. 2001/0011740) as applied to claim 14 above, and further in view of Toshio (JP 04-092423). The Examiner has rejected claims 16 and 19 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer '740 as applied to claim 14 above, and further in view of Slomowitz (US Patent 4,888,088). The Examiner has rejected claims 24, 25, 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer '740 in view of Slomowitz '088. The Examiner has rejected claims 26 and 29 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer '740 and Slomowitz '088 as applied to claim 24 above, and further in view of Hasegawa (US Patent 5,677,015). The Examiner has rejected claims 7 and 15 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer '740 as applied to claims 1 and 14 above, and further in view of Park et al. (US Patent 5,910,218). The Examiner has rejected claim 31 under 35 U.S.C. § 103(a) as being unpatentable over DeBoer '740 and Slomowitz '088 as applied to claim 24 above, and further in view of Park et al. (US Patent 5,910,218).

It is Applicant's understanding that DeBoer either alone or in combination with Toshio or Slomowitz, Hasegawa or Park fails to teach or render obvious Applicant's invention as claimed in claims 1-9, 11, 12, 14-29 and 31. In claims 1-9, 11, 12, 14-29 and 31, Applicant teaches and claims a method of forming a high quality dielectric layer. According to Applicant's method, a dielectric layer is formed on a substrate. A plasma comprising ionized oxygen atoms is then generated in a first chamber. The ionized oxygen

atoms are then fed through a conduit coupling the first chamber to a second chamber where the substrate having a dielectric layer to anneal is located. While the ionized oxygen atoms travel through the conduit to the second chamber the ionized atoms become electrically neutral. The dielectric layer is then exposed to the electrically neutral oxygen atoms in the second chamber. By flowing the plasma mixture through a conduit for a sufficient period of time to insure all of the ionized atoms become electrically neutral, the substrate is only exposed to an electrically neutral, highly reactive oxygen atoms and not to ionized oxygen atoms. Ionized oxygen atoms can be electrically damaging to the substrate and electrical devices formed thereon. The reactive atomic oxygen atoms are in a highly energized state so that they are highly reactive with the dielectric film and therefore can fill vacancies in the lattice which left unfilled can lead to high leakage current and poor device performance. Additionally, because the atomic oxygen's are in a highly energized state when they enter the anneal chamber, they readily react with the dielectric film and do not require high substrate temperature to initiate reaction. In the present invention, Applicant is able to suitably anneal dielectric films at temperatures less than 400°C. The low temperature process of the present invention, can substantially reduce the thermal budget necessary to manufacture modern integrated circuits. Applicant does not understand DeBoer or any of the cited references to teach annealing a dielectric film with highly energized electrically neutral reactive oxygen atoms in order to improve the electrical characteristics of a dielectric film of a semiconductor device.

It is Applicant's understanding that the DeBoer fails to teach annealing a dielectric film with highly reactive electrically neutral oxygen atoms as claimed by Applicant.

Applicant understands DeBoer as teaching a method of forming a capacitor having a tantalum oxynitride film. DeBoer describes forming a tantalum oxide film over a bottom electrode 104. The tantalum oxide dielectric is subsequently transformed into a tantalum oxynitride ($Ta_xN_yO_z$) film 102. Prior to or after the transformation of the tantalum oxide film into a tantalum nitride oxide film, the film can be annealed in an environment containing oxygen.

DeBoer, however, does not describe that the oxygen anneal occurs by exposing the dielectric layer to electrically neutral reactive oxygen atoms formed from a plasma comprising ionized oxygen atoms. It is to be appreciated that in an embodiment of DeBoer, DeBoer teaches transforming a tantalum oxide film into a tantalum oxynitride film by exposing the film to a nitrogen atmosphere in the presence of a plasma. It is to be appreciated that this nitrogen plasma treatment is used to convert the tantalum oxide film into a tantalum oxynitride film and is not used during the oxygen anneal described in paragraph 33 of DeBoer. As such, DeBoer clearly fails to teach or render obvious either alone or in combination with Slomowitz or Toshio Applicant's invention as claimed in claims 1-9, 11, 12, 14-29 and 31. As such, Applicant respectfully requests the removal of the 35 U.S.C. 103 rejections of these claims.

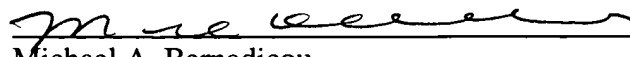
Additionally, the Examiner has held that the Declaration filed on September 3, 2002 under 37 CFR § 1.131 as being ineffective to overcome DeBoer et al. reference because the reference claims the same patentable invention as claimed by Applicant. Applicant strongly disagrees. Applicant is unable to find a single claim of DeBoer et al. (claims 1-54) which claims exposing a dielectric film to electrically neutral reactive oxygen atoms formed by generating an ionized oxygen atoms in a first chamber and flowing the ionized oxygen atoms through a conduit coupling the first chamber to a second chamber wherein the ionized atoms become electrically neutral reactive oxygen atoms as claimed by Applicant. As such, it is Applicant's position that DeBoer '740 reference should be removed as an effective reference in lieu of the 37 CFR § 1.131 Declaration filed September 3, 2002.

If there are any additional charges, please charge Deposit Account No. 02-2666.

Respectfully submitted,

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